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# Discard sampling of the Dutch beam trawl fleet in 2008

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# Summary

This report provides the results of the discards sampling program on the Dutch beam trawl fishery in the North Sea in 2008. The program was instigated in 2002 as part of the EC regulations 1543/2000 and 1639/2001 on data collection regulation (DCR) in European fisheries. In 2008 ten trips on commercial beam trawlers with an engine power larger than 300 HP fishing using 80 mm mesh size are observed. Samples of the discards and landings were counted and measured, and raised to catches per hour, per trip, per quarter and per year. Other commercial bottom trawling fleets were not sampled in this project.

In 2008, the average percentage discards for sole was estimated at 16% in numbers and 6% in weight for the sampled vessels. This is the lowest discard rate observed for sole since 2002. Higher discard rates in previous years were caused by the strong year class of 2005 (ICES, 2008). In 2008 this year class has reached marketable lengths and explains the drop in discard rates compared to the previous years, when year class 2005 was still abundant in the discarded part of the catch.

The estimated discard rate for plaice in the sampled trips in 2008 is estimated at 84% in numbers and 53% in weight. Although variation between observed trips is high, the average discard rate is within the range as previous years, between 76% en 86%. New studies on spatio-temporal distribution patterns of juvenile plaice will provide more insight in the discard behavior of this species in the near future.

Through time dab has been the most abundant species in the fish discards. Since 1976 the discard estimate of this species in numbers has varied between 91% and 99%. Also in 2008 the estimated discard rate, 95%, is within this range. The discard rates calculated for cod (35% in weight) and whiting (93% in weight), are based on low catch numbers. These rates are, therefore, considered highly uncertain.

A new Data Collection Framework (2008/949/EG) became effective in 2009. Compared to the previous regulation, a more intensified sampling strategy results in an increased number of metiers that are considered for discard sampling purposes. Consequently, almost all member states are required to increase the sampling effort of their discard monitoring programs. To meet these new standards within a reasonable budget, IMARES started a self-sampling program with 12 commercial vessels in April 2009

The discard observer program forms an important source of information to verify outcomes of newly developed sampling methods. Continuation of the observer program, parallel with the development of alternative methods, like the self-sampling program, is, therefore, strongly recommended.

# Samenvatting

In dit rapport staan de resultaten van het discardsbemonsteringsprogramma van de Nederlandse boomkorvisserij in de Noordzee in 2008 beschreven. Het programma wordt sinds 2002 op deze wijze uitgevoerd als invulling van EC regelingen 1543/2000 en 1639/2001 voor verzameling van gegevens in Europese visserijen (DCR programma). In 2008 zijn tien reizen op de Nederlandse boomkorschepen met een motorvermogen groter dan 300 PK vissend met een maaswijdte van 80 mm bemonsterd. De discards en aanlandingen werden geteld en gemeten en vervolgens opgewerkt tot vangsten per vis uur, per reis, per kwartaal en per jaar. Andere commercial bodem trawlers zijn niet bemonsterd binnen dit project,

Het gemiddelde discard percentage voor tong voor de bemonsterde boomkorschepen in 2008 is geschat op 16% in aantallen en 6% in gewicht. Dit is het laagste discard percentage voor tong sinds 2002. Hoger discard percentages in voorgaande jaren zijn veroorzaakt door de sterke jaarklasse van 2005 (ICES, 2008). In 2008 heeft deze jaarklasse een marktwaardige lengte bereikt en verklaart het lager vastgestelde percentage discards in vergelijking met vorige jaren, toen de 2005 jaarklasse nog veel werd waargenomen was in de discard-fractie van de vangst.

Het gemiddelde discard percentage voor schol in 2008 is geschat op 84% in aantallen en 53% in gewicht. Hoewel de spreiding tussen de bemonsterde reizen hoog is valt het gemiddelde discardpercentage binnen de verwachte range van voorgaande jaren, tussen de 76% en 86%. Recent onderzoek op het gebied van de spreiding in ruimte en tijd voor juveniele schol gaat in de nabije toekomst ook meer inzicht verschaffen in de discardpatronen van ondermaatse schol.

Schar is de meest talrijke soort in de discard-fractie van de vangst in de boomkorvisserij (in aantallen 91% tot 99%). Ook in 2008 is het geschatte percentage discard, 95%, weer vergelijkbaar met voorgaande jaren. De discardschattingen voor kabeljauw, 35% in gewicht, en wijting, 93% in gewicht, zijn gebaseerd op lage aantallen in de monsters en worden daarom als onzeker beschouwd.

In 2009 is een nieuwe Data Verordening (2008/949/EG) van kracht gegaan. In vergelijking met de vorige verordening is hierin is een intensiever programma voor discardbemonstering vastgesteld. Als gevolg van deze nieuwe verordening moeten bijna alle lidstaten de bemonsteringsintensiteit drastisch verhogen. Om de gewenste intensiteit te kunnen bereiken binnen een toelaatbaar budget is Nederland in april 2009 gestart met een 'self-sampling' project.

Ondanks de ontwikkelingen van alternatieve bemonsteringsmethode zijn bemonsteringsprogramma's, zoals het discard programma van IMARES nog steeds erg belangrijk. Deze langlopende programma's vormen een betrouwbare basis waarop uitkomsten van nieuwe projecten getest en gevalideerd kunnen worden. Continuering van het discard waarnemingsprogramma wordt is daarom van belang.

# 1 Introduction

Discard is the part of the catch taken in a fishery that is not retained on board and, consequently, thrown back into the sea. In 2005, the Food and Agriculture Organization of the United Nations (FAO) estimated a weighted discard rate at 8 percent (portion of the catch discarded) in the world's marine fisheries in the 1992-2001 period. Based on this discard rate yearly average discards are estimated to be 7.3 million tonnes ((FAO, 2007)).

Discarding is caused by economic, biological, environmental or social factors or a combination of these factors (ICES, 2004a; Catchpole *et al.*, 2005). During commercial fishing practices four different types of discarding can be recognized:

1) specimens of commercial species do not com[ply to the minimum legal landing size;
2) surplus to quota: species which is not allowed to be landed when this results to exceeding legal quota;
3) bycatch species of no commercial value;
4) commercial fish with an undesired quality (low value); this type of discarding is commonly referred to as high-grading.

Discarding leads to lower profits from fish stocks, because generally a large part of the discards will not survive the catching and sorting process ((Beek *et al.*, 1990; Jennings and Kaiser, 1998).Correct estimates are, therefore, of importance to fisheries management. Conversely, due to large spatial heterogeneity in the distribution of fish, seasonal variability and differences in fishing gear used, discard estimates of single hauls can be very variable, and may lead to imprecise discard estimates (Aarts and Helmond, 2007). Increasing sampling effort of discards on commercial fleets will increase the precision level. However, increasing sampling effort through increasing the number of observed trips in discard monitoring programs is time consuming and very expensive. In an attempt to increase the precision level in discard sampling programs, alternative monitoring methods are tested and studied in several member states of the EU. In the Netherlands, a self-sampling program started in 2009 to increase sampling effort in space and time within a reasonable budget.

To date, in North Sea fisheries, discards are only incorporated into a few stock assessments such as haddock, cod, whiting and plaice (ICES, 2005; 2006). The intention is to incorporate discards estimates in the assessments for all stocks where it is significant and where relevant information becomes available. However, including discard data might also increase the noise in the assessment because the high variability in the data (Dickey-Collas *et al.*, 2007). Alternative sampling methods may increase the data quality in the near future (Helmond, 2009).

The Dutch beam-trawl fishery is a bottom trawling mixed fishery, fishing with 80-89 mm mesh size in the cod-end, targeting a limited number of demersal species that are of commercial interest, in particular sole (*Solea solea*) in the southern part of the North Sea and plaice (*Pleuronectes platessa*) in the northern fishing grounds. Consequently, a major part of the catch consists of other species that live on or near the seabed. In general this part of the catch is of no commercial interest and is thrown overboard (discarded).

Discard data collected during an observer program on beam trawl vessels between 1976 and 1990 showed great variation in the quantity of plaice discarded (18-31% by weight (Beek, 1998)). Recent sampling (between 1999 - 2007) indicate that the percentage of plaice discarded has increased to 54% in weight (82% in numbers) (Keeken *et al.*, 2003); (Keeken and Pastoors, 2004; 2005; Keeken, 2006; Helmond and Overzee, 2007).

From 2002 onwards discards data have been collected under the DCR[1]. This report gives an overview of the results of the Dutch demersal discard sampling program for 2008, which focuses on beam trawl vessels larger than 300 HP fishing with 80 mm mesh size.

[1] EC Data Collection Regulations 1543/2000 and 1639/2001 (EC., 2000, 2001; Anon., 2002; ICES, 2003).

# 2 Methods

## 2.1 General information

Selection of the vessels is quasi-random and based on co-operative sampling (ICES, 2000). This means that co-operation of a skipper with the project is on voluntarily basis. On forehand it is difficult to predict the sampling location, since this depends on the fishing strategy of the skipper. However, vessels from different regions are selected during a quarter to obtain widespread coverage. During 2008 a total of ten trips were made on board of Dutch beam trawl vessels with an engine power between 1379-1839 KW (HP = 1.34*KW). All vessels fished with an 80 mm[1] cod-end mesh size (Table 2.1.1).

## 2.2 Sampling procedures

For each discard sampling trip, two observers go onboard a vessel, sampling at least 60% of the hauls (Beek, 2001). After each haul, the marketable fish is sorted from the catch by the crew of the vessel on a conveyer-belt. From each sampled haul, a representative sub-sample of the discards was taken from the conveyer belt by the observers. All fish in the sub-sample were counted and measured. Benthic invertebrates were only counted. Total and sampled volume of discards was recorded. In addition, sub-samples of the landed fish were measured, and total and sampled landings weight were recorded. If possible, otoliths were collected from the commercial important discarded fish species (plaice, sole, dab) for age readings. All data was entered into a computer program on haul-by-haul basis and later transferred into a central database.

Sampling protocol per haul:

1) Estimation total catch per haul. Registration of total catch in volume.
2) Take sample of discards.
    a. The sample consists of one basket (35 kg). To get a representative sample, discards are taken at different moments from the conveyer belt when processing the haul.
3) Measuring discard sample:
    a. Sort all fish species, take length measurements and register total number by species and length class.
    b. Sort all benthos and register total number by species.
4) Measuring landings sample:
    a. Sample landings from target species (sole and plaice), 10-15 kg. Register total number by species and length class.
    b. Sample landings from non-target species (e.g. dab, turbot, brill, whiting, cod) 10-15 kg. Register total number by species and length class.
5) Age estimations of discards:
    a. Sample otoliths from most discarded commercial species (plaice, sole and dab).
    b. The sample of age analysis consists of undersized fish. A sample consists of minimal 3 individuals per length class per area (ICES quadrant).
6) Information on position, haul duration, wind direction, fishing depth en landed catch is collected in cooperation with the skipper for each haul.
7) Registration of total landings:
    c. Information on total landings is collected at the end of the trip.

[1] In this report a mesh size of 80-99 mm is referred to as 80mm cod-end mesh size

## 2.3 Raising procedures

A short description of the raising procedures used to work up the raw data to annual estimates of discards in the beam trawl fleet is given in this paragraph. The raising procedures are the same as applied in previous years. A more detailed mathematical description of the raising procedure is given in Appendix I.

Sampled numbers of fish per haul were raised to numbers at length, and for some species at age, for both discards and landings. Different raising procedures were used for discards and landings because different sources of information were used for these catch components. For the landings the total landed weight per species by trip was available from the auction, while such data was not available for discards.

Discards were raised from sampled numbers in a haul to total numbers in a haul with the ratio of estimated haul volume to sampled haul volume. Total numbers per haul were summed over all sampled hauls in a trip and divided by duration of the sampled hauls to obtain total numbers discarded per hour per trip. Numbers were converted to weight using standard length-weight relationships.

Landings were raised from sampled numbers per haul to total numbers per trip with the ration of total landings weight in the trip to sampled landings weight. Total numbers landed were calculated by dividing total numbers in the trip by the trip duration. Landed weight per hour was calculated by dividing total landings weight by trip duration.

An average of numbers landed and discarded at length per hour were calculated per period (quarter or year) by multiplying total numbers at length in a trip over the trips in this period dividing this by total duration of trips in this period. Numbers at age were calculated from numbers at length using age-length keys, which calculate the proportion of fish at length (l) with age (a). Numbers at age landed and discarded are raised to fleet level by effort-ratio: multiplying total numbers at age in the sampled trips with the ratio of hpeffort (effort in days at sea multiplied by the engine power of the vessel in HP) of the fleet to hpeffort of the sampled trips.

# 3 Results

## 3.1 Sampling

During the ten sampled trips the total number of hauls in the trips varied between 29 and 54, with an average fishing duration of 80 hours per trip (Table 3.1.1). 67% of all hauls were sampled for discards and 58% for landings. Otoliths of plaice (279 otoliths), dab (262 otoliths) and sole (15 otoliths) were collected from the discards samples.

The sampling occurred during quarters 1, 2, 3 and 4. Per quarter between 0.18% and 0.43% of the effort (in days at sea) of the Dutch beam trawl fleet with engine power larger than 300 HP fishing with 80 mm cod-end mesh size was sampled (Table 3.1.2). Fleet coverage by year was 0.30% in hpeffort for this fleet segment (Table 3.1.2).

The spatial distribution of fishing effort in the Dutch beam trawl fleet larger than 300 HP fishing with 80 mm cod-end mesh size was extracted from VIRIS and is shown in Figure 3.1.1a. The fleet is mainly distributed offshore from the Dutch coast. The distribution of all sampled vessels is presented in Figure 3.1.1b. This shows that the spatial distribution of sampling efforts covers the major areas for the whole fleet.

## 3.2 Numbers and weight

The total landings weight by trip for the observed vessels varied between 1016 and 8458 kg for plaice and between 957 and 2612 for sole (Table 3.2.1a). Sampled landings weight for all trips varied between 66 and 276 kg for plaice and between 34 and 402 kg for sole (Table 3.2.1b).

The average weight of all discards on the observed beam trawl vessels (both fish and invertebrate discards) was estimated to be around 28.6 tonnes per trip (CV 35%, Table 3.2.2a). About 32% of the catch weight consisted of fish landings and 25% consisted of fish discards, while about 1% of the catch numbers consisted of fish landings and 3% consisted of fish discards (Figure 3.2a). Dab and plaice were the most abundant fish species in the discards (Table 3.2.3a, Figure 3.2b). The sand star, common starfish, helmet crab, swimming crab and brittle star were the most abundant benthos species (Table 3.2.3b).

## 3.3 Species

**Plaice**
On average 72,897 plaice individuals (CV 89%) weighing 5,571 kg (CV 75%) were discarded per trip by the beam trawl vessels (Tables 3.2.2a,b). The average number per hour discarded was 902 compared to 169 individuals landed. This resulted in an average discard percentage of 84% in numbers and 53% in weight (Table 3.3.1). The average discard percentage per quarter varied between 63% and 94% in numbers and 30% and 72% in weight (Table 3.3.2). Between rectangles, the number discarded per hour varied between 311 and 2,188 (Figure 3.3.1).

Plaice were caught from 9 cm onwards during the beam trawl trips (Table 3.3.3). The peak of the discards length distribution was around 20 cm (Table 3.3.3, Figure 3.4.1). Plaice were discarded up to 39 cm whereas the minimum landing size is 27 cm. Most discards during the beam trawl trips were between ages 1 and 3, with the highest number at the age of 2 (2006 year class). Most landings were between ages 2 and 5 (Table 3.3.4)

Landings and discards in numbers at age were raised to fleet level for beam trawl vessels larger than 300 HP and are presented in Table 3.3.5.

**Sole**

On average 1,216 sole individuals (CV 97%) weighing 115 kg (CV 101%) were discarded per trip by the beam trawlers (Tables 3.2.2a,b). In all trips landings were higher than discards (Table 3.3.6). The average discard percentage was 16% in number and 6% in weight. The variation per quarter was between 4% and 27% in numbers and 2% and 9% in weight (Table 3.3.7).

Sole was discarded up to 31 cm during the beam trawl trips. The peak of the discard length distribution was around 21 cm (Table 3.3.8, Figure 3.4.1). The highest number of landings were from the strong 2005 year class at the age of 3 while the highest number of discards was at age 2 (Table 3.3.9).

Landings and discards in numbers at age were raised to fleet level for beam trawl vessels larger than 300 HP (Table 3.3.10).

**Dab**

On average 70,618 dab individuals (CV 58%) weighing 3,894 kg (CV 58%) were discarded per trip by the beam trawl vessels (Tables 3.2.2a,b). Per hour on average 49 kg was discarded compared to 8 kg landed (Table 3.3.11). The average discard percentage was 95% in numbers and 87% in weight. Per quarter the discard percentage varied in weight between 77% and 94% (Table 3.3.12).

**Cod**

On average 464 cod individuals (CV 187%) weighing 78 kg (CV 180%) were discarded per trip by the beam trawl vessels (Tables 3.2.2a,b). Per hour on average less than 1 kg cod was discarded (Table 3.3.13). The average discard percentage was 35% in weight. This estimate is however highly uncertain because of the low catches. Per quarter the discard percentage varied in weight between 0% and 81% (Table 3.3.14).

**Whiting**

On average 2,757 whiting individuals (CV 72%) weighing 219 kg (CV 86%) were discarded per trip by the beam trawl vessels (Tables 3.2.2a,b). Discards in weight were higher than landings with less than 1 kg whiting landed compared to 3 kg discarded per hour (Table 3.3.15). The average discard percentage was 93% in weight. Per quarter the discard percentage in weight varied between 88% and 94% (Table 3.3.16).

# 4 Discussion

The discard estimates presented in this paper are obtained by an observer sampling program. Similar to previous years the sampling program does not entirely cover the fishing effort of the North Sea fleet. Due to limited resources, only the largest métier of Dutch beam vessels with an engine power larger than 300 HP and using a mesh-size of 80-99 mm, is covered by the program. Beam trawlers using mesh size of 100 mm and larger and vessels with an engine power less than 300 HP (so called Eurocutters) are not included. Also vessels using chain mats instead of tickler chains are not included.

Due to the limited number of observations (10 trips with 440 sampled hauls), sampling-effort in 2008 was, like previous years, less than 1%. Consequently, temporal and spatial distribution of the sampled fishing effort of this fleet are poorly covered. Estimates of total discards for less abundant species, especially those which show large seasonal and spatial differences in discarding, must therefore be considered as very uncertain.

The discard percentage of sole in 2008, 16% in number and 6% in weight, is the lowest observed since 2002 (Table 4.1). Over the last 6 years the discard rate of sole have varied between 23% and 29% in numbers and between 13% and 17% in weight. Higher discard rates in previous years were caused by the strong year class of 2005 (ICES, 2008). This year the 2005 year class reached the marketable size (MLS = 24 cm) are were not observed in the discard fraction of the catch. However, this year class is now abundant in the landings at age 3 (Table 3.3.10).This contributed to the lower discard rates for sole in 2008.

The estimated discard rate of plaice was 84% in numbers and 53% in weight is within the line of expectation for the last 10 years (Table 4.2).. Discard rates between trips was high and varied, between 24% and 94% (in weight) (Table 3.3.1.). Age 1 and 2 were the most abundant age-groups discarded over the year (Table 3.3.5), with the exception of the first quarter, where age 3 is also abundant in the discarded fraction of the catch (Table 3.3.5). During this period of the year, age 3 is still below the minimum landing size (MLS= 27cm), which results in higher discard rates during this period. The estimated number of discards of age 1 in quarter 1 (Table 3.3.4 and 3.3.5) is high compared to the numbers of previous years (Keeken, 2006; Helmond and Overzee, 2007).However, numbers are based on only two trips during this period, of which one trip, R95, has very high discard rate for plaice, 98% in number and 94% In weight (Table 3.3.1).With the help of an new approach, where statistical modeling is applied to estimate the spatio-temporal distribution of juvenile plaice, we are able to provide a more comprehensive analysis on age-groups during different periods in the year. The first results of this research, based on data of this sampling program, will be published in 2010.

As in previous years, the catches of cod in the beam trawl fishery were very low. The main reason for the low cod catches is the low stock size in the North Sea. It is clear that the absolute numbers caught have decreased substantially in comparison with the 1970s and 1980s (Keeken and Pastoors, 2004). The discard rate for cod in 2008 is estimated at 35%, but due to low sampling effort in combination with the low observed numbers, considered to be very uncertain. The discard rates have a low precision are, therefore, not very representative for the fleet. A comparison with data available from the Belgian sampling program revealed that catches of cod in beam trawl fisheries using chain mats are higher than for vessels using tickler chains (STECF, 2008). Beam trawlers using chain mats fish in areas with rocky bottom structures, where cod is more abundant. Unfortunately, beam trawlers using chain mats are not included in the Dutch sampling programs. Although the estimated discard rate is already considered uncertain, missing chain mats in the program can also result in an under estimation of cod discard rates.

Dab is the most abundant discarded species since the start of this monitoring program. The discard percentage of dab in 2008 was 95% in numbers and 87% in weight and is considered to be representative for the métier. These values are comparable with the estimates observed in previous years (Table 4.3).

Whiting is a bycatch species in the beam trawl fishery. A decreasing trend over time in numbers and weight of catches per hour (Table 4.4) was observed In the analysis of 2007 data (Van Helmond & van Overzee, 2008). This trend is persistent and continued in the data of 2008. It is still under discussion of this trend may reflect a decline in stock size or a change in distribution of the stock outside the area where beam trawlers operate. The percentages of discarding observed in the whole time period are high but has not be estimated with high precision due to the low numbers of whiting in the samples of landings and discards.

From 2009 onwards, a new Data Collection Regulation (2008/949/EG) obligates member states to increase the sampling effort of their discard monitoring programs in order to achieve a sampling coverage of 90% of their métiers. Constrained by high costs and lack of trained observers, the Netherlands choose to expand her monitoring program with a self-sampling project together with the help of the Dutch fishery industry. This resulted in co-operative pilot project between IMARES and the fishing industry which started in April 2009. This pilot project will it make possible to expand the sampling to more métiers and increase the number of observations on discarding. The new sampling program will also provide information on the spatio-temporal distribution of discards, which allows more sophisticated analyses of the data.. Although it is expected that the information provided by the new program eventually will improve estimates on discard rates for a large number of métiers, continuation of a discard observer program will remain important to validate the discard estimates of the new sampling methods.

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# Appendix I: Raising procedures

**Table I**. Explanation of the abbreviations used in the formulas in appendix I.

| | explanation | sub-script | explanation |
|---|---|---|---|
| n | sampled number | l | length |
| N | total number | h | haul |
| w | sampled weight | | hour |
| | | o | |
| W | total weight | t | trip |
| v | sampled discards volume | p | period |
| V | total discards volume | y | year |
| u | sampled duration | s | species |
| U | total duration | f | fleet |
| wt | sampled landings weight | | |
| WT | total landings weight | | |
| e | sampled fleet effort in number of trips | | |
| E | total fleet effort in number of trips | | |
| T | Number of trips | | |
| DN | total discard number | | |
| LN | total landings number | | |
| CN | total catch number (landings and discards combined) | | |

**Raising discards per trip**

The sampled number per length and haul were raised per species to total number per length and haul

$$DN_{l,h,s} = \frac{V_h}{v_h} Dn_{l,h,s}$$

where $DN_{l,h,s}$ is the total number discarded at length (l) in haul (h) for species (s), $V_h$ is total volume of haul (h), $v_h$ is sampled volume of haul (h) and $Dn_{l,h,s}$ sampled number discarded at length (l) in haul (h) for species (s).

The total number discarded at length per haul and species was summed over the sampled hauls to obtain the total sampled number discarded at length (l) for species (s) over all sampled hauls (h). The total number discarded ($DN_{l,t,s}$) at length (l) per trip (t) and species (s) was calculated by multiplying the total number discarded ($DN_{l,h,s}$) over all sampled hauls with the ratio of total trip duration ($U_t$) and duration of all sampled hauls ($\Sigma u_h$):

$$DN_{l,t,s} = \frac{U_t}{\sum u_h} \sum_{h=i}^{h} DN_{l,h,s}$$

The number discarded at length per hour and species ($DN_{l,o,t,s}$) was calculated by dividing the total number at length per trip ($DN_{l,t,s}$) by total trip duration ($U_t$).

$$DN_{l,o,t,s} = \frac{DN_{l,t,s}}{U_t}$$

The obtained number discarded at length per hour ($DN_{l,o,t,s}$) was summed over length to obtain the number discarded per hour ($DN_{o,t,s}$):

$$DN_{o,t,s} = \sum_{l=i} DN_{l,o,t,s}$$

Discarded weight per hour per species at length was calculated using length-weight relationships:

$$DW_{l,o,t,s} = \sum_{l} \left( \frac{DN_{l,o,t,s} * A_s * l^{Bs}}{U_t} \right)$$

where $DW_{l,o,t,s}$ is the weight per length, per hour and per species, $DN_{l,o,t,s}$ is the number discarded at length, per hour and per species and $A_s$ and $B_s$ species specific constants.

**Raising landings per trip**

The sampled number landed at length per haul and species ($Ln_{l,h,s}$) were summed over all sampled hauls ($h$) to calculate the sampled number at length for the trip ($n_{l,t,s}$). The total number landed at length for the entire trip ($LN_{l,t,s}$) was calculated by multiplying the sampled number at length for the trip ($Ln_{l,t,s}$) with the ratio of total trip weight obtained from auction or VIRIS data ($WT_{t,s}$) to sampled landings weight of the trip ($wt_{t,s}$):

$$LN_{l,t,s} = \frac{WT_{t,s}}{wt_{t,s}} \left( \sum_{h=i}^{h} Ln_{l,h,s} \right)$$

Number landed at length per hour per species ($LN_{l,o,t,s}$) was calculated by dividing total number landed at length per trip ($LN_{l,t,s}$) by the trip duration ($U_t$).

$$LN_{l,o,t,s} = \frac{LN_{l,t,s}}{U_t}$$

The obtained total number at length per hour ($LN_{l,o,t,s}$) was summed to calculate number per hour per species ($LN_{o,t,s}$):

$$LN_{o,t,s} = \sum_{l=i} LN_{l,o,t,s}$$

Total landings weight per hour ($LW_{o,t,s}$) was calculated per species by dividing total landings weight ($WT_{t,s}$) per species by total trip duration ($U_t$).

$$LW_{o,t,s} = \frac{WT_{t,s}}{U_t}$$

**Numbers at length, per quarter and year**

The number of discards and landings ($CN_{l,o,p,s}$) at length per hour was calculated per quarter/year by summing the number landings or discards at length per hour per trip ($CN_{l,o,t,s}$) over all trips in that period (p) and then dividing this by the total number of trips ($U_t$) in this period:

$$CN_{l,o,p,s} = (\sum_{p} CN_{l,o,t,s}) / \sum_{p} U_t$$

Total numbers discards or landings ($CN_{o,p,s}$) were calculated by summing over length. Trips were excluded from calculation numbers per hour per period if landings were not measured during a trip, but auction records existed for this species.

$$CN_{o,p,s} = \sum_{l=i} CN_{l,o,p,s}$$

**Numbers at age, per quarter and year**

The age structure of both plaice and sole discard and landings was calculated by distribution of numbers at length over age groups using age-length-keys (ALK). The number landed and discarded ($CN_{l,a,t,s}$) at length and age per trip and species was calculated by distribution of the proportion ($f_{l,a}$) of fish at length (l) with age (a) over the number ($CN_{l,t,s}$) at length per trip and species. Because $f_{l,a}$ is dependent on the period, ALK were taken from discards and market samples from the quarter were discards were sampled.

$$CN_{l,a,t,s} = f_{l,a} * CN_{l,t,s}$$

The number landed and discarded ($CN_{a,t,s}$) at age per trip and species was calculated by multiplying the number landed and discarded ($CN_{l,a,t,s}$) at length and age per trip and species over length:

$$CN_{a,t,s} = \sum_{l=i} CN_{l,a,t,s}$$

The number of discards and landings ($CN_{a,o,p,s}$) at age per hour was calculated per quarter/year by summing the number of landings or discards at age per hour per trip ($CN_{a,o,t,s}$) over all trips in that period (p) and then dividing this by the total number of trips ($U_t$) in this period:

$$CN_{a,o,p,s} = (\sum_{p} CN_{a,o,t,s}) / \sum_{p} U_t$$

**Numbers at age, per quarter and year per fleet**

Total landings en discards ($CN_{a,p,s,f}$) at age per quarter/year were calculated for the entire fleet by multiplying the total numbers of discards and landings ($N_{a,p,s}$) at age per quarter/year with the ratio effort of the entire fleet ($E_{p,f}$) per quarter/year measured in Hpeffort (proportion fishing duration per day multiplied with engine power) to the effort of the sampled part of the fleet in Hpeffort per quarter ($e_{p,f}$).

$$CN_{a,p,s,f} = \frac{E_{p,f}}{e_{p,f}} CN_{a,p,s}$$

Trips were excluded from calculation numbers per hour per period if landings were not measured during a trip, but auction records existed for this species.

# Appendix II: Tables and Figures

**Table 2.1.1.** Characteristics per trip sampled in 2008. For each vessel the gear (TBB=beam trawl), the engine power in KW, the mesh size in mm and sampled ICES rectangles are represented.

| Mesh | Gear | Vessel | KW | Quarter | Sampled ICES rectangles |
|---|---|---|---|---|---|
| 80 | TBB | R94 | 1467 | 1 | 33/F3, 34/F3, 35/F3, 36/F3 |
| | | R95 | 1471 | 1 | 32/F2, 32/F3, 33/F2, 33/F3 |
| | | R96 | 1397 | 2 | 36/F4, 36/F5, 36/F6, 37/F5, 37/F6, 38/F7, 39/F6, 39/F7, 40/F7 |
| | | R97 | 1471 | 2 | 34/F3, 34/F4, 35/F3 |
| | | R98 | 1471 | 2 | 33/F2, 33/F3, 33/F4, 34/F2, 34/F3, 34/F4, 35/F2 |
| | | R102 | 1839 | 3 | 36/F2, 37/F1 |
| | | R103 | 1471 | 3 | 34/F3, 35/F2, 35/F3 |
| | | R104 | 1469 | 4 | 34/F4, 35/F2, 35/F3, 35/F4, 36/F3 |
| | | R105 | 1469 | 4 | 35/F1, 35/F2, 36/F2 |
| | | R106 | 1467 | 4 | 33/F2, 33/F3 |

**Table 3.1.1.** Sampling effort per trip sampled in 2008. For each trip the duration and number of hauls sampled for landings and discards and total duration and number of hauls for the total trips are given, and the number of plaice, dab and sole otoliths taken from the discard fraction.

| Mesh | | | Number of hauls | | | Duration (hours) | | | Plaice | Dab | Sole |
|---|---|---|---|---|---|---|---|---|---|---|---|
| size | Gear | Vessel | Land | Disc | Tot | Land | Disc | Tot | Otolith | Otolith | Otolith |
| 80 | TBB | R95 | 13 | 33 | 42 | 26 | 65 | 83 | 37 | 37 | |
| | | R98 | 36 | 37 | 50 | 63 | 65 | 86 | 47 | 58 | |
| | | R106 | 28 | 29 | 39 | 56 | 58 | 77 | 34 | 33 | 15 |
| | | R103 | 16 | 17 | 50 | 30 | 32 | 96 | | | |
| | | R96 | 28 | 38 | 54 | 41 | 56 | 79 | 33 | 28 | |
| | | R97 | 29 | 30 | 48 | 52 | 54 | 88 | 35 | 25 | |
| | | R104 | 31 | 31 | 43 | 54 | 54 | 75 | | | |
| | | R105 | 26 | 26 | 40 | 46 | 46 | 72 | | | |
| | | R102 | 27 | 30 | 45 | 47 | 52 | 75 | 53 | 40 | |
| | | R94 | 21 | 22 | 29 | 47 | 49 | 66 | 40 | 41 | |
| | | **Total** | **255** | **293** | **440** | **462** | **531** | **797** | **279** | **262** | **15** |
| | | **%Total** | **58%** | **67%** | | **58%** | **67%** | | | | |

**Table 3.1.2.** Sampling effort in 2008 in days at sea (D.A.S.) and hp-effort (HPeff, days at sea corrected for engine power) per trip and per quarter for the sampled trips and for the fleet larger than 300 HP using 80 mm mesh size and using beam trawl (fleet data from VIRIS), and fleet coverage by the sampled trips.

| | | Sampled effort | | Fleet effort | | Fleet coverage | |
|---|---|---|---|---|---|---|---|
| Quarter | Vessel | D.A.S. | HPeff | D.A.S. | HPeff | D.A.S. | HPeff |
| 1 | R95 | 4 | 7892 | | | | |
| | R94 | 3 | 5901 | | | | |
| | Total | 7 | 13793 | 3807 | 7698084 | 0.18% | 0.18% |
| 2 | R98 | 4 | 7892 | | | | |
| | R97 | 5 | 9865 | | | | |
| | R96 | 5 | 9500 | | | | |
| | Total | 14 | 27257 | 3266 | 6548953 | 0.43% | 0.42% |
| 3 | R103 | 4 | 7884 | | | | |
| | R102 | 4 | 9864 | | | | |
| | Total | 8 | 17748 | 3236 | 6453192 | 0.25% | 0.28% |
| 4 | R106 | 4 | 7868 | | | | |
| | R104 | 5 | 9850 | | | | |
| | R105 | 5 | 9850 | | | | |
| | Total | 14 | 27568 | 3901 | 7802827 | 0.36% | 0.35% |
| **All** | **Total** | **43** | **86366** | **14210** | **28503056** | **0.30%** | **0.30%** |

**Table 3.2.1a.** Total landings weight per trip in 2008 for plaice, sole, cod, whiting, dab, turbot and brill for the beam trawl (TBB) with an engine power larger than 300 HP using 80 mm cod-end mesh size.

| HP | Mesh | Gear | Vessel | Quar | Plaice | Sole | Cod | Whiting | Dab | Turbot | Brill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| >300 | 80 | TBB | R94 | 1 | 4282 | 1601 | 40 | 7 | 604 | 199 | 34 |
| | | | R95 | 1 | 1016 | 2084 | 50 | 49 | 830 | 203 | 150 |
| | | | R96 | 2 | 4336 | 957 | 38 | 4 | 2413 | 684 | 553 |
| | | | R97 | 2 | 3411 | 1330 | 92 | 25 | 545 | 282 | 117 |
| | | | R98 | 2 | 2516 | 1212 | 189 | 40 | 468 | 387 | 186 |
| | | | R102 | 3 | 5951 | 1524 | 544 | 14 | 286 | 65 | 119 |
| | | | R103 | 3 | 5983 | 2509 | 41 | 0 | 229 | 350 | 146 |
| | | | R104 | 4 | 4666 | 2612 | 39 | 0 | 175 | 272 | 157 |
| | | | R105 | 4 | 7099 | 2190 | 26 | 3 | 202 | 233 | 93 |
| | | | R106 | 4 | 8458 | 2335 | 278 | 40 | 206 | 248 | 296 |
| | | | | **Mean** | **4772** | **1835** | **134** | **18** | **596** | **292** | **185** |

**Table 3.2.1b.** Sampled landings weight per trip in 2008 for plaice, sole, cod, whiting, dab, turbot and brill for the beam trawl (TBB) with an engine power larger than 300 HP using 80 mm cod-end mesh size.

| HP | Mesh | Gear | Vessel | Quar | Plaice | Sole | Cod | Whiting | Dab | Turbot | Brill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| >300 | 80 | TBB | R94 | 1 | 205 | 134 | 0 | 0 | 12 | 0 | 0 |
| | | | R95 | 1 | 66 | 81 | 0 | 0 | 6 | 0 | 0 |
| | | | R96 | 2 | 116 | 91 | 0 | 0 | 76 | 19 | 20 |
| | | | R97 | 2 | 151 | 129 | 0 | 0 | 0 | 0 | 0 |
| | | | R98 | 2 | 200 | 135 | 0 | 0 | 0 | 0 | 0 |
| | | | R102 | 3 | 123 | 120 | 0 | 0 | 0 | 0 | 0 |
| | | | R103 | 3 | 95 | 34 | 0 | 0 | 13 | 0 | 0 |
| | | | R104 | 4 | 276 | 286 | 0 | 0 | 84 | 22 | 19 |
| | | | R105 | 4 | 226 | 402 | 0 | 0 | 31 | 0 | 0 |
| | | | R106 | 4 | 143 | 148 | 0 | 0 | 0 | 0 | 0 |
| | | | | **Mean** | **160** | **156** | **0** | **0** | **22** | **4** | **4** |

**Table 3.2.2a.** Total weight (kg) in 2008 of all discards per trip (fish and benthos) and of plaice, sole, dab, cod and whiting for the beam trawl (TBB) with an engine power larger than 300 HP using 80 mm cod-end mesh size.

| HP | Mesh | Gear | Vessel | All Discards | Plaice | Sole | Dab | Cod | Whiting |
|---|---|---|---|---|---|---|---|---|---|
| >300 | 80 | TBB | R94 | 9488 | 1353 | 44 | 1128 | 1 | 150 |
| | | | R95 | 28643 | 14770 | 76 | 8633 | 420 | 682 |
| | | | R96 | 30941 | 3946 | 47 | 5671 | 16 | 140 |
| | | | R97 | 26156 | 10262 | 60 | 2906 | 220 | 142 |
| | | | R98 | 26242 | 2970 | 96 | 3111 | 112 | 215 |
| | | | R102 | 38881 | 2594 | 18 | 5998 | 0 | 110 |
| | | | R103 | 18348 | 2486 | 46 | 2533 | 0 | 51 |
| | | | R104 | 27266 | 4463 | 194 | 2313 | 0 | 70 |
| | | | R105 | 43664 | 5327 | 165 | 4374 | 0 | 267 |
| | | | R106 | 36279 | 7540 | 404 | 2276 | 8 | 360 |
| | | | **Mean** | **28591** | **5571** | **115** | **3894** | **78** | **219** |
| | | | **CV** | **35%** | **75%** | **101%** | **58%** | **180%** | **86%** |

**Table 3.2.2b.** Total number in 2008 of plaice, sole, dab, cod and whiting discards for the beam trawl (TBB) with an engine power larger than 300 HP using 80 mm cod-end mesh size.

| HP | Mesh | Gear | Vessel | Plaice | Sole | Dab | Cod | Whiting |
|---|---|---|---|---|---|---|---|---|
| >300 | 80 | TBB | R94 | 22453 | 567 | 21978 | 25 | 1979 |
| | | | R95 | 223248 | 1061 | 151048 | 2648 | 7659 |
| | | | R96 | 61178 | 551 | 92070 | 111 | 2294 |
| | | | R97 | 150583 | 733 | 50107 | 1306 | 1897 |
| | | | R98 | 38891 | 834 | 72214 | 456 | 2349 |
| | | | R102 | 27250 | 157 | 121954 | 0 | 1143 |
| | | | R103 | 24057 | 385 | 53501 | 0 | 1296 |
| | | | R104 | 55580 | 1973 | 44986 | 73 | 1264 |
| | | | R105 | 54241 | 1760 | 67362 | 0 | 3603 |
| | | | R106 | 71487 | 4138 | 30958 | 23 | 4082 |
| | | | **Mean** | **72897** | **1216** | **70618** | **464** | **2757** |
| | | | **CV** | **89%** | **97%** | **58%** | **187%** | **72%** |

**Table 3.2.3a.** Numbers of fish discarded per hour in 2008 for the beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size.

| English name | Dutch name | TBB |
|---|---|---|
| Ammodytes sp. | Ammodytes | 6.0 |
| Black seabream | Zeekarper | <0.1 |
| Blonde ray | Blonde rog | 0.1 |
| Brill | Griet | 0.2 |
| Bull-rout | Zeedonderpad | 2.8 |
| Cod | Kabeljauw | 5.5 |
| Dab | Schar | 886.3 |
| Dragonet | Pitvis | 43.6 |
| Five-bearded rockling | Vijfdradige meun | <0.1 |
| Flounder | Bot | 2.7 |
| Four-bearded rockling | Vierdradige meun | 0.2 |
| Garfish | Geep | 0.1 |
| Greater pipefish | Grote zeenaald | 0.1 |
| Greater sand-eel | Smelt | 7.7 |
| Grey gurnard | Grauwe poon | 34.3 |
| Hake | Heek | <0.1 |
| Herring | Haring | 0.5 |
| Hooknose | Harnasmannetje | 2.9 |
| Horse mackerel | Horsmakreel | 0.1 |
| John Dory | Zonnevis | 0.5 |
| Lemon sole | Tongschar | 5.7 |
| Lesser spotted dogfish | Hondshaai | 2.2 |
| Lesser weever | Kleine pieterman | 15.8 |
| Long rough dab | Lange schar | 1.6 |
| Lumpsucker | Snotolf | <0.1 |
| Plaice | Schol | 902.3 |
| Pollack | Witte koolvis | <0.1 |
| Pomatoschistus sp. | Grondel | 0.9 |
| Poor cod | Dwergbolk | 0.5 |
| Red gurnard | Engelse poon | <0.1 |
| Reticulated dragonet | Rasterpitvis | 0.1 |
| Roker | Stekelrog | 0.4 |
| Sand sole | Franse tong | <0.1 |
| Scaldfish | Schurftvis | 48.9 |
| Sea scorpion | Groene zeedonderpad | 0.2 |
| Smoothhound | Gladde haai | <0.1 |
| Snake pipefish | Adderzeenaald | <0.1 |
| Sole | Tong | 15.7 |
| Solenette | Dwergtong | 57.5 |
| Spotted ray | Gevlekte rog | 1.1 |
| Sprat | Sprot | 0.1 |
| Starry ray | Sterrog | 0.2 |
| Striped red mullet | Mul | 0.1 |
| Three-bearded rockling | Driedradige meun | 0.2 |
| Tub gurnard | Rode poon | 6.1 |
| Turbot | Tarbot | 0.5 |
| Twaite shad | Fint | 0.2 |
| Whiting | Wijting | 34.9 |
| bib | Steenbolk | 2.2 |

**Table 3.2.3b.** Numbers of benthic species discarded per hour in 2008 for the beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size.

| Latin name | Dutch name | TBB |
|---|---|---|
| Abra alba | Witte Dunschaal | 0.2 |
| Acanthocardia echinata | Gedoornde Hartschelp | 7.1 |
| Aequipecten opercularis | Wijde mantel | 0.1 |
| Alcyonium digitatum | Dodemansduim | 30.8 |
| Anthozoa | Zeeanemonen | 8.1 |
| Aphrodita aculeate | Fluwelen zeemuis | 66.6 |
| Arctica islandica | Noordkromp | 0.6 |
| Ascidiacea | Zakpijp | 1.7 |
| Asterias rubens | Zeester | 1961.4 |
| Astropecten irregularis | Kamster | 2852.3 |
| Aurelia aurita | Oorkwal | 0.3 |
| Buccinum undatum | Wulk | 4.6 |
| Cancer pagurus | Noordzeekrab | 6.0 |
| Cephalopoda | Cephalopoda | 0.0 |
| Common mussel | Mossel | 0.7 |
| Corystes cassivelaunus | Helmkrab | 961.7 |
| Crangon crangon | Gewone garnaal | 3.8 |
| Cyanea sp. | Haarkwal | 0.1 |
| Ebalia cranchi | Kleine kiezelkrab | 0.0 |
| Echinidae | Zeeegels | 7.4 |
| Echinocardium cordatum | E. cordatum | 504.6 |
| Echinocardium sp. | Hartegels | 259.0 |
| Eledone cirrhosa | Eledone | 0.3 |
| Ensis sp. | Ensis | 0.1 |
| Flustra foliacea | Bladachtig hoornwier | 0.1 |
| Goneplax rhomboids | G. rhomboides | 1.1 |
| Halichondria panacea | Broodspons | 0.2 |
| Hydrozoa | Hydroidpoliepen | 0.2 |
| Leander serratus | Gezaagde steurgarnaal | 0.2 |
| Liocarcinus depurator | Blauwpootzwemkrab | 16.5 |
| Liocarcinus holsatus | Gewone zwemkrab | 891.9 |
| Liocarcinus marmoreus | Gemarmerde zwemkrab | 5.1 |
| Loligo forbesi | L. forbesi | 0.2 |
| Loligo sp. | Loligo | 0.8 |
| Loligo subulata | Dwergpijlinktvis | 3.3 |
| Lunatia alderi | Glanzende tepelhoorn | 0.1 |
| Lunatia catena | Grote tepelhoorn | 0.0 |
| Macoma balthica | Nonnetje | 1.8 |
| Mactra coralline | Grote strandschelp | 0.7 |
| Necora puber | Fluwelen zwemkrab | 3.4 |
| Norway lobster | Noorse kreeft | 0.5 |
| Octopus vulgaris | Octopus | 0.0 |
| Ophiura albida | Kleine Slangster | 0.6 |
| Ophiura ophiura | Slangster | 858.1 |
| Pagurus bernhardus | P. bernhardus | 213.1 |
| Pagurus sp. | Pagurus sp. | 51.7 |
| Pecten maximus | St. Jacobsschelp | 6.7 |
| Pinnotheres pisum | Erwtenkrabbetje | 0.8 |
| Pleurobrachia pileus | Ribkwal | 0.2 |
| Psammechinus miliaris | Zeeappel | 9.7 |
| Sepia officinalis | Zeekat | 1.0 |
| Sepiola sp. | Sepiola | 0.7 |
| Thia scutellata | Nagelkrab | 0.1 |

**Table 3.3.1**. Plaice. Landings (L), discards (D) and percentage discards (%D) per hour in numbers (left) and weight (right) for beam trawl (TBB) with an engine power larger than 300 HP using 80 mm mm cod-end mesh size in 2008.

| | | | | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **HP** | **Mesh** | **Gear** | **Vessel** | **Quart** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| >300 | 80 | TBB | R94 | 1 | 131 | 340 | 72% | 65 | 20 | 24% |
| | | | R95 | 1 | 48 | 2701 | 98% | 12 | 179 | 94% |
| | | | R96 | 2 | 169 | 777 | 82% | 55 | 50 | 48% |
| | | | R97 | 2 | 129 | 1713 | 93% | 39 | 117 | 75% |
| | | | R98 | 2 | 89 | 454 | 84% | 29 | 35 | 54% |
| | | | R102 | 2 | 224 | 361 | 62% | 79 | 34 | 30% |
| | | | R103 | 3 | 142 | 252 | 64% | 63 | 26 | 29% |
| | | | R104 | 3 | 169 | 745 | 81% | 63 | 60 | 49% |
| | | | R105 | 4 | 276 | 756 | 73% | 99 | 74 | 43% |
| | | | R106 | 4 | 313 | 923 | 75% | 109 | 97 | 47% |
| | | | | **Mean** | **169** | **902** | **84%** | **61** | **69** | **53%** |

**Table 3.3.2.** Plaice. Average landings (L), discards (D) and percentage discards (%D) per hour and per quarter in numbers (left) and weight (right) for beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|
| **Quarter** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| 1 | 90 | 1520 | 94% | 39 | 100 | 72% |
| 2 | 129 | 981 | 88% | 41 | 67 | 62% |
| 3 | 183 | 307 | 63% | 71 | 30 | 30% |
| 4 | 190 | 793 | 81% | 83 | 73 | 47% |

**Table 3.3.3.** Plaice. Number landed and discarded per hour per length class for beam trawl vessels (TBB) with an engine power larger than 300 HP using 80 mm cod-end mesh in 2008.

| Length | TBB>300 HP, 80 mm | |
|---|---|---|
| (cm) | Discards | Landings |
| 8 | | |
| 9 | 0.2 | |
| 10 | 1.0 | |
| 11 | 4.1 | |
| 12 | 7.6 | |
| 13 | 20.9 | |
| 14 | 28.5 | |
| 15 | 40.6 | |
| 16 | 48.5 | |
| 17 | 79.5 | |
| 18 | 96.5 | <0.1 |
| 19 | 97.9 | |
| 20 | 106.0 | |
| 21 | 82.6 | |
| 22 | 77.7 | <0.1 |
| 23 | 53.6 | 0.1 |
| 24 | 60.6 | 0.1 |
| 25 | 43.7 | 0.8 |
| 26 | 30.3 | 4.5 |
| 27 | 11.9 | 20.3 |
| 28 | 4.8 | 26.8 |
| 29 | 1.9 | 23.0 |
| 30 | 0.2 | 20.3 |
| 31 | 0.3 | 16.2 |
| 32 | 0.7 | 12.9 |
| 33 | 0.2 | 8.7 |
| 34 | 0.4 | 8.1 |
| 35 | 0.5 | 6.4 |
| 36 | 0.3 | 4.3 |
| 37 | 0.7 | 3.7 |
| 38 | 0.4 | 3.8 |
| 39 | 0.1 | 2.9 |
| 40 | | 1.9 |
| 41 | 0.0 | 0.9 |
| 42 | | 1.1 |
| 43 | | 0.4 |
| 44 | | 0.3 |
| 45 | | 0.3 |
| 46 | | 0.4 |
| 47 | | <0.1 |
| 48 | | 0.4 |
| 49 | | 0.1 |
| 50 | | 0.1 |

**Table 3.3.4.** Plaice. Average numbers landed (L) and discarded (D) calculated at age per hour per quarter and per year for beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | Quarter 1 | | Quarter 2 | | Quarter 3 | | Quarter 4 | | Year | |
|---|---|---|---|---|---|---|---|---|---|---|
| Age | D | L | D | L | D | L | D | L | D | L |
| 0 | 0.8 | | 4.5 | | | | 1.8 | | 2.4 | |
| 1 | 537.0 | | 237.2 | 0.2 | 16.6 | 12.1 | 293.9 | 7.1 | 270.1 | 7.6 |
| 2 | 813.1 | 1.1 | 662.1 | 23.0 | 254.1 | 61.3 | 461.3 | 50.5 | 550.5 | 34.5 |
| 3 | 140.1 | 33.0 | 74.2 | 46.4 | 35.1 | 39.4 | 48.7 | 73.4 | 71.9 | 50.4 |
| 4 | 16.3 | 30.5 | 3.7 | 23.6 | 0.6 | 23.4 | 1.9 | 44.9 | 5.5 | 31.3 |
| 5 | 6.5 | 14.8 | 0.5 | 17.6 | 0.5 | 19.7 | 1.5 | 35.6 | 2.2 | 22.9 |
| 6 | 1.2 | 1.7 | 0.4 | 5.0 | 0.1 | 8.1 | 0.0 | 9.4 | 0.4 | 6.3 |
| 7 | 5.7 | 7.3 | 0.5 | 7.2 | 0.2 | 9.1 | 0.3 | 16.8 | 1.7 | 10.5 |
| 8 | 0.6 | 0.9 | | 1.3 | 0.1 | 3.9 | | 1.3 | 0.4 | 1.7 |
| 9 | | 0.5 | | 1.0 | 0.2 | 3.0 | | 5.8 | 0.2 | 3.0 |
| 10 | | 0.2 | | 3.9 | | 3.2 | | 8.0 | 0.2 | 4.7 |

**Table 3.3.5.** Plaice. Landings (L) and discards D) raised estimates of total fleet numbers (*1000) and mean length at age (cm), total weight (*1000) tonnes and mean weight at age (kg) per quarter and at age per year for beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | | Numbers (*1000) | | Mean Length | | Weight (*1000) | | Mean Weight | |
|---|---|---|---|---|---|---|---|---|---|
| Quarter | Age | D | L | D | L | D | L | D | L |
| 1 | 0 | 68 | | 9.9 | | 0.6 | | 0.008 | |
| | 1 | 48904 | | 16.1 | | 1931.6 | | 0.039 | |
| | 2 | 73149 | 85 | 19.3 | 25.7 | 4907.1 | 12.9 | 0.067 | 0.152 |
| | 3 | 12431 | 2519 | 23.1 | 29.9 | 1449.9 | 615.5 | 0.117 | 0.244 |
| | 4 | 1393 | 2326 | 28.8 | 30.7 | 327.1 | 621.0 | 0.235 | 0.267 |
| | 5 | 583 | 1120 | 32.4 | 32.2 | 188.4 | 352.3 | 0.323 | 0.315 |
| | 6 | 55 | 125 | 35.2 | 36.8 | 21.6 | 57.7 | 0.393 | 0.461 |
| | 7 | 521 | 553 | 31.8 | 33.3 | 161.2 | 199.8 | 0.310 | 0.362 |
| | 8 | 26 | 67 | 35.2 | 37.8 | 10.5 | 33.9 | 0.398 | 0.502 |
| | 9 | | 18 | | 46.7 | | 17.1 | | 0.936 |
| | 10 | | 6 | | 51 | | 7.0 | | 1.205 |
| 2 | 0 | 11 | | 10.0 | | 0.10 | | 0.009 | |
| | 1 | 14882 | 6 | 15.9 | 18 | 552.0 | 0.3 | 0.037 | 0.052 |
| | 2 | 51291 | 1546 | 20.0 | 28.3 | 3787.6 | 318.6 | 0.074 | 0.206 |
| | 3 | 3316 | 3051 | 25.1 | 29.2 | 474.4 | 693.1 | 0.143 | 0.227 |
| | 4 | 326 | 1174 | 25.8 | 32.5 | 53.0 | 375.7 | 0.162 | 0.320 |
| | 5 | 30 | 697 | 31.1 | 33.2 | 8.5 | 243.9 | 0.279 | 0.350 |
| | 6 | 11 | 137 | 28.2 | 31.6 | 2.3 | 41.1 | 0.200 | 0.301 |
| | 7 | 12 | 202 | 28.2 | 32.5 | 2.4 | 66.1 | 0.201 | 0.327 |
| | 8 | | 40 | | 38.1 | | 20.6 | | 0.518 |
| | 9 | | 31 | | 36.4 | | 13.9 | | 0.453 |
| | 10 | | 108 | | 34.2 | | 41.2 | | 0.380 |
| 3 | 0 | | | | | | | | |
| | 1 | 998 | 788 | 20.7 | 27.3 | 79.5 | 143.5 | 0.080 | 0.182 |
| | 2 | 15456 | 3947 | 21.9 | 29.4 | 1496.2 | 911.1 | 0.097 | 0.231 |
| | 3 | 2157 | 2349 | 23.5 | 32.3 | 261.3 | 730.2 | 0.121 | 0.311 |
| | 4 | 15 | 1358 | 29.3 | 32.9 | 3.4 | 447.6 | 0.228 | 0.330 |
| | 5 | 13 | 1113 | 29.4 | 33.0 | 3.0 | 375.0 | 0.228 | 0.337 |
| | 6 | 3 | 460 | 30.0 | 34.2 | 0.6 | 173.3 | 0.242 | 0.377 |
| | 7 | 5 | 513 | 31.0 | 35.2 | 1.3 | 212.4 | 0.267 | 0.414 |
| | 8 | 4 | 217 | 30.6 | 34.0 | 0.9 | 83.0 | 0.258 | 0.382 |
| | 9 | 5 | 164 | 28.0 | 33.8 | 0.9 | 66.2 | 0.196 | 0.405 |
| | 10 | | 185 | | 38.4 | | 100.0 | | 0.542 |
| 4 | 0 | 36 | | 10.0 | | 0.3 | | 0.009 | |
| | 1 | 18633 | 453 | 20.1 | 27.7 | 1359.5 | 86.7 | 0.073 | 0.191 |
| | 2 | 29300 | 3209 | 22.2 | 29.0 | 3018.7 | 712.6 | 0.103 | 0.222 |
| | 3 | 3101 | 4658 | 25.8 | 30.0 | 476.6 | 1170.3 | 0.154 | 0.251 |
| | 4 | 118 | 2844 | 28.1 | 31.0 | 23.4 | 794.7 | 0.199 | 0.279 |
| | 5 | 98 | 2257 | 28.1 | 31.5 | 19.7 | 672.2 | 0.200 | 0.298 |
| | 6 | 1 | 593 | 30.0 | 34.3 | 0.2 | 227.4 | 0.242 | 0.383 |
| | 7 | 20 | 1064 | 29.0 | 33.2 | 4.4 | 373.6 | 0.219 | 0.351 |
| | 8 | | 80 | | 42.5 | | 56.6 | | 0.706 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 9 | | 366 | | 35.0 | | 149.6 | | 0.409 |
| | 10 | 11 | 507 | 29.1 | 33.3 | 2.3 | 193.8 | 0.220 | 0.382 |

**Table 3.3.6.** Sole. Landings (L), discards (D) and percentage discards (%D) per hour in numbers (left) and weight (right) for beam trawl (TBB) with an engine power larger than 300 HP using 80 mm mm cod-end mesh size in 2008.

| | | | | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **HP** | **Mesh** | **Gear** | **Vessel** | **Quart** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| >300 | 80 | TBB | R94 | 1 | 94 | 9 | 8% | 24 | <1 | 3% |
| | | | R95 | 1 | 77 | 13 | 14% | 25 | <1 | 4% |
| | | | R96 | 2 | 42 | 7 | 14% | 12 | <1 | 5% |
| | | | R97 | 2 | 63 | 8 | 12% | 15 | <1 | 4% |
| | | | R98 | 2 | 63 | 10 | 13% | 14 | 1 | 7% |
| | | | R102 | 3 | 78 | 2 | 3% | 20 | <1 | 1% |
| | | | R103 | 3 | 73 | 4 | 5% | 26 | <1 | 2% |
| | | | R104 | 4 | 133 | 26 | 17% | 35 | 3 | 7% |
| | | | R105 | 4 | 107 | 25 | 19% | 31 | 2 | 7% |
| | | | R106 | 4 | 122 | 53 | 30% | 30 | 5 | 15% |
| | | | | **Mean** | **95** | **16** | **16%** | **23** | **1** | **6%** |

**Table 3.3.7.** Sole. Average landings (L), discards (D) and percentage discards (%D) per hour and per quarter in numbers (left) and weight (right) for beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|
| **Quarter** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| 1 | 85 | 11 | 11% | 25 | <1 | 3% |
| 2 | 56 | 8 | 13% | 14 | <1 | 5% |
| 3 | 75 | 3 | 4% | 23 | <1 | 2% |
| 4 | 90 | 33 | 27% | 33 | 3 | 9% |

**Table 3.3.8.** Sole. Number landed and discarded per hour per length class for beam trawl vessels (TBB) and otter bottom trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh in 2008.

| **Length** | **TBB > 300 HP, 80 mm** | |
|---|---|---|
| **(cm)** | **Discards** | **Landings** |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | 0.2 | |
| 12 | | |
| 13 | <0.1 | |
| 14 | <0.1 | |
| 15 | 0.5 | |
| 16 | 0.2 | |
| 17 | 0.4 | |
| 18 | 0.4 | |
| 19 | 0.9 | |
| 20 | 1.9 | <0.1 |
| 21 | 3.6 | 0.2 |
| 22 | 2.8 | 0.7 |
| 23 | 2.6 | 2.4 |
| 24 | 1.4 | 7.4 |
| 25 | 0.3 | 9.7 |
| 26 | 0.1 | 9.8 |

| | | |
|---|---|---|
| 27 | 0.2 | 9.4 |
| 28 | <0.1 | 8.8 |
| 29 | | 8.2 |
| 30 | <0.1 | 6.6 |
| 31 | <0.1 | 5.8 |
| 32 | | 4.9 |
| 33 | | 3.5 |
| 34 | | 2.5 |
| 35 | | 1.6 |
| 36 | | 1.0 |
| 37 | | 0.9 |
| 38 | | 0.5 |
| 39 | | 0.4 |
| 40 | | 0.2 |
| 41 | | 0.2 |
| 42 | | 0.1 |
| 43 | | <0.1 |
| 44 | | |
| 45 | | <0.1 |
| 46 | | <0.1 |
| 47 | | <0.1 |
| 48 | | |
| 49 | | |
| 50 | | |

**Table 3.3.9.** Sole. Average numbers landed (L) and discarded (D) calculated at age per hour per quarter and per year for beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | Quarter 1 | | Quarter 2 | | Quarter 3 | | Quarter 4 | | Year | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | **D** | **L** | **D** | **L** | **D** | **L** | **D** | **L** | **D** | **L** |
| 0 | | | | | 0.2 | | | | 0.2 | |
| 1 | 2.4 | | 1.1 | | 0.6 | 0.9 | 27.4 | 19.2 | 9.1 | 11.9 |
| 2 | 4.2 | 6.8 | 3.2 | 3.6 | 0.8 | 8.9 | 2.9 | 14.2 | 2.8 | 8.5 |
| 3 | 4.0 | 61.8 | 2.6 | 22.4 | 1.4 | 42.4 | 4.0 | 65.3 | 3.1 | 47.1 |
| 4 | <0.1 | 5.3 | 1.1 | 7.2 | 0.1 | 11.3 | 0.3 | 10.8 | 0.6 | 8.7 |
| 5 | | 6.2 | 0.3 | 7.6 | 0.1 | 3.4 | | 4.1 | 0.2 | 5.5 |
| 6 | | 0.6 | 0.2 | 4.1 | 0.1 | 3.0 | 0.5 | 3.9 | 0.3 | 3.4 |
| 7 | <0.1 | 3.8 | 0.2 | 7.0 | | 3.2 | | 2.0 | 0.1 | 4.1 |
| 8 | | 0.9 | 0.1 | 1.8 | | 0.2 | | 0.1 | 0.1 | 0.8 |
| 9 | | 0.2 | <0.1 | 0.9 | | 1.2 | | 0.6 | <0.1 | 0.8 |
| 10 | | 0.2 | <0.1 | 1.7 | | 0.7 | | 1.9 | <0.1 | 1.2 |

**Table 3.3.10.** Sole. Landings (L) and discards D) raised estimates of total fleet numbers (*1000) and mean length at age (cm), total weight (*1000) tonnes and mean weight at age (kg) per quarter and at age per year for beam trawl vessels with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | | Numbers (*1000) | | Mean Length | | Weight (*1000) | | Mean Weight | |
|---|---|---|---|---|---|---|---|---|---|
| Quarter | Age | D | L | D | L | D | L | D | L |
| 1 | 0 | | | | | | | | |
| | 1 | 208 | | 16.9 | | 9.4 | | 0.045 | |
| | 2 | 361 | 584 | 18.9 | 26.0 | 23.7 | 106.3 | 0.066 | 0.182 |
| | 3 | 337 | 5292 | 21.7 | 27.4 | 33.4 | 1153.1 | 0.099 | 0.218 |
| | 4 | 1 | 478 | 26.0 | 29.4 | 0.2 | 133.0 | 0.176 | 0.278 |
| | 5 | | 549 | | 30.4 | | 172.8 | | 0.315 |
| | 6 | | 30 | | 40.0 | | 22.2 | | 0.734 |
| | 7 | 1 | 337 | 26.0 | 31.4 | 0.2 | 124.1 | 0.176 | 0.369 |
| | 8 | | 92 | | 32.0 | | 32.1 | | 0.349 |
| | 9 | | 8 | | 42.0 | | 6.9 | | 0.860 |
| | 10 | | 11 | | 41.0 | | 8.4 | | 0.794 |
| 2 | 0 | | | | | | | | |
| | 1 | 74 | | 18.4 | | 4.1 | | 0.056 | |
| | 2 | 220 | 256 | 20.5 | 24.4 | 18.3 | 37.5 | 0.083 | 0.147 |
| | 3 | 171 | 1654 | 22.3 | 27.2 | 19.1 | 343.9 | 0.112 | 0.208 |
| | 4 | 71 | 510 | 23.0 | 27.8 | 8.4 | 120.3 | 0.119 | 0.236 |
| | 5 | 23 | 598 | 24.8 | 27.0 | 3.5 | 128.2 | 0.153 | 0.214 |
| | 6 | 7 | 249 | 27.0 | 30.3 | 1.4 | 77.1 | 0.201 | 0.310 |
| | 7 | 7 | 546 | 27.1 | 29.2 | 1.4 | 154.3 | 0.205 | 0.282 |
| | 8 | 4 | 97 | 27.7 | 29.8 | 0.9 | 28.3 | 0.218 | 0.292 |
| | 9 | <1 | 46 | 28.0 | 32.0 | 0.1 | 17.1 | 0.224 | 0.370 |
| | 10 | 1 | 80 | 26.0 | 31.2 | 0.1 | 28.9 | 0.176 | 0.361 |
| 3 | 0 | 5 | | 14.0 | | 0.1 | | 0.023 | |
| | 1 | 38 | 53 | 17.5 | 26.0 | 1.9 | 9.4 | 0.052 | 0.176 |
| | 2 | 49 | 532 | 22.4 | 26.0 | 5.6 | 95.0 | 0.113 | 0.178 |
| | 3 | 97 | 2691 | 24.3 | 28.3 | 14.0 | 652.0 | 0.144 | 0.242 |
| | 4 | 3 | 711 | 29.5 | 30.9 | 0.7 | 229.6 | 0.272 | 0.323 |
| | 5 | 3 | 196 | 24.5 | 31.0 | 0.5 | 65.8 | 0.145 | 0.336 |
| | 6 | 2 | 168 | 29.1 | 31.2 | 0.6 | 58.1 | 0.263 | 0.346 |
| | 7 | | 184 | | 32.9 | | 76.5 | | 0.415 |
| | 8 | | 9 | | 41.6 | | 7.9 | | 0.839 |
| | 9 | | 72 | | 31.7 | | 26.7 | | 0.372 |
| | 10 | | 38 | | 30.6 | | 13.0 | | 0.338 |
| 4 | 0 | | | | | | | | |
| | 1 | 1754 | 1222 | 21.3 | 25.1 | 164.0 | 194.2 | 0.093 | 0.159 |
| | 2 | 186 | 891 | 21.5 | 27.5 | 18.8 | 194.8 | 0.101 | 0.219 |
| | 3 | 253 | 4167 | 22.5 | 29.2 | 28.0 | 1131.9 | 0.110 | 0.272 |
| | 4 | 14 | 673 | 24.0 | 29.5 | 1.9 | 194.0 | 0.135 | 0.288 |
| | 5 | | 258 | | 32.9 | | 103.3 | | 0.400 |
| | 6 | 21 | 245 | 25.0 | 28.6 | 3.2 | 66.4 | 0.155 | 0.272 |
| | 7 | | 123 | | 31.5 | | 45.9 | | 0.372 |

| | | | | |
|---|---|---|---|---|
| 8 | 8 | 39.5 | 5.9 | 0.705 |
| 9 | 12 | 35.0 | 5.9 | 0.477 |
| 10 | 39 | 30.0 | 11.0 | 0.282 |

**Table 3.3.11.** Dab. Landings (L), discards (D) and percentage discards (%D) per hour in numbers (left) and weight (right) for beam trawl (TBB) with an engine power larger than 300 HP using 80 mm mm cod-end mesh size in 2008. *nm*=not measured.

| | | | | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **HP** | **Mesh** | **Gear** | **Vessel** | **Quart** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| >300 | 80 | TBB | R94 | 1 | 39 | 333 | 90% | 9 | 17 | 65% |
| | | | R95 | 1 | 50 | 1827 | 97% | 10 | 104 | 91% |
| | | | R96 | 2 | 185 | 1169 | 86% | 31 | 72 | 70% |
| | | | R97 | 2 | nm | 570 | | 6 | 33 | 84% |
| | | | R98 | 2 | nm | 844 | | 5 | 36 | 87% |
| | | | R102 | 3 | nm | 1617 | | 4 | 80 | 95% |
| | | | R103 | 3 | 8 | 560 | 99% | 2 | 27 | 92% |
| | | | R104 | 4 | 12 | 603 | 98% | 2 | 31 | 93% |
| | | | R105 | 4 | 14 | 940 | 99% | 3 | 61 | 96% |
| | | | R106 | 4 | nm | 400 | | 3 | 29 | 92% |
| | | | | **Mean** | **51** | **905** | **95%** | **8** | **49** | **87%** |

**Table 3.3.12.** Dab. Average landings (L), discards (D) and percentage discards (%D) per hour and per quarter in numbers (left) and weight (right) for beam trawl vessel with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|
| **Quarter** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| 1 | 45 | 1080 | 96% | 10 | 61 | 86% |
| 2 | 185 | 861 | 82% | 14 | 47 | 77% |
| 3 | 8 | 1089 | 99% | 3 | 53 | 94% |
| 4 | 9 | 636 | 99% | 3 | 38 | 94% |

**Table 3.3.13.** Cod. Landings (L), discards (D) and percentage discards (%D) per hour in numbers (left) and weight (right) for beam trawl (TBB) with an engine power larger than 300 HP using 80 mm mm cod-end mesh size in 2008. *nm*=not measured.

| | | | | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **HP** | **Mesh** | **Gear** | **Vessel** | **Quart** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| >300 | 80 | TBB | R94 | 1 | *nm* | <1 | - | <1 | <1 | 2% |
| | | | R95 | 1 | *nm* | 32 | - | <1 | 5 | 89% |
| | | | R96 | 2 | *nm* | 1 | - | <1 | <1 | 30% |
| | | | R97 | 2 | *nm* | 15 | - | 1 | 3 | 71% |
| | | | R98 | 2 | *nm* | 5 | - | 2 | 1 | 37% |
| | | | R102 | 3 | *nm* | 0 | - | 7 | 0 | 0% |
| | | | R103 | 3 | *nm* | 0 | - | <1 | 0 | 0% |
| | | | R104 | 4 | *nm* | <1 | - | <1 | <1 | 0% |
| | | | R105 | 4 | *nm* | 0 | - | <1 | 0 | 0% |
| | | | R106 | 4 | *nm* | <1 | - | 4 | <1 | 3% |
| | | | | **Mean** | | **5** | **-** | **2** | **<1** | **35%** |

**Table 3.3.14.** Cod. Average landings (L), discards (D) and percentage discards (%D) per hour and per quarter in numbers (left) and weight (right) for beam trawl vessel with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|
| **Quarter** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| 1 | | 16 | | <1 | 3 | 81% |
| 2 | | 7 | | 1 | 1 | 52% |
| 3 | | 0 | | 4 | 0 | 0% |
| 4 | | <1 | | 1 | <1 | 2% |

**Table 3.3.15.** Whiting. Landings (L), discards (D) and percentage discards (%D) per hour in numbers (left) and weight (right) for beam trawl (TBB) with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008. *nm*=not measured.

| | | | | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **HP** | **Mesh** | **Gear** | **Vessel** | **Quart** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| >300 | 80 | TBB | R94 | 1 | *nm* | 30 | | <1 | 2 | 96% |
| | | | R95 | 1 | *nm* | 93 | | <1 | 8 | 93% |
| | | | R96 | 2 | *nm* | 29 | | <1 | 2 | 97% |
| | | | R97 | 2 | *nm* | 22 | | <1 | 2 | 85% |
| | | | R98 | 2 | *nm* | 27 | | <1 | 3 | 84% |
| | | | R102 | 3 | *nm* | 15 | | <1 | 1 | 89% |
| | | | R103 | 3 | 0 | 14 | 100% | 0 | <1 | 100% |
| | | | R104 | 4 | 0 | 17 | 100% | 0 | <1 | 100% |
| | | | R105 | 4 | *nm* | 50 | | <1 | 4 | 99% |
| | | | R106 | 4 | *nm* | 53 | | <1 | 5 | 90% |
| | | | | **Mean** | **0** | **15** | 100% | <1 | **3** | 93% |

**Table 3.3.16.** Whiting. Average landings (L), discards (D) and percentage discards (%D) per hour and per quarter in numbers (left) and weight (right) for beam trawl vessel with an engine power larger than 300 HP using 80 mm cod-end mesh size in 2008.

| | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|
| **Quarter** | **L** | **D** | **%D** | **L** | **D** | **%D** |
| 1 | | 61 | | <1 | 5 | 94% |
| 2 | | 26 | | <1 | 2 | 88% |
| 3 | 0 | 14 | | <1 | <1 | 91% |
| 4 | 0 | 40 | | <1 | 3 | 94% |

**Table 4.1.** Sole. Average landings (L), discards (D) and percentage discards (%D) per hour and per period in numbers (left) and weight (right) for beam trawl vessels. Results over 1976-1983 and 1989-1990 from Van Beek (1998), 1999-2001 from Netherlands Institute for Fisheries Research unpublished data.

| Year/ | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|
| Period | N trips | L | D | %D | L | D | %D |
| 1976-1979 | 21 | 116 | 8 | 6% | 32 | 1 | 4% |
| 1980-1983 | 24 | 85 | 24 | 22% | 19 | 3 | 15% |
| 1989-1990 | 6 | 286 | 83 | 22% | 48 | 12 | 20% |
| 1999 | 3 | 112 | 16 | 13% | 32 | 2 | 5% |
| 2000 | 12 | 90 | 25 | 22% | 22 | 2 | 10% |
| 2001 | 4 | 82 | 17 | 17% | 17 | 1 | 6% |
| 2002 | 6 | 126 | 38 | 23% | 18 | 3 | 13% |
| 2003 | 9 | 95 | 32 | 25% | 20 | 3 | 14% |
| 2004 | 8 | 175 | 69 | 28% | 31 | 7 | 17% |
| 2005 | 8 | 99 | 29 | 23% | 20 | 2 | 11% |
| 2006 | 9 | 64 | 26 | 29% | 16 | 2 | 13% |
| 2007 | 10 | 94 | 27 | 23% | 22 | 2 | 10% |
| 2008 | 10 | 95 | 16 | 16% | 23 | 1 | 6% |

**Table 4.2.** Plaice. Average landings (L), discards (D) and percentage discards (%D) per hour and year/period in numbers (left) and weight (right) for beam trawl vessels. Results over 1976-1983 and 1989-1990 from Van Beek (1998), 1999-2001 from Netherlands Institute for Fisheries Research unpublished data.

| Year/ | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|
| Period | N trips | L | D | %D | L | D | %D |
| 1976-1979 | 21 | 253 | 185 | 42% | 108 | 28 | 20% |
| 1980-1983 | 24 | 309 | 418 | 57% | 99 | 51 | 34% |
| 1989-1990 | 6 | 392 | 330 | 46% | 104 | 46 | 30% |
| 1999 | 3 | 145 | 181 | 55% | 42 | 18 | 29% |
| 2000 | 12 | 194 | 601 | 76% | 50 | 47 | 48% |
| 2001 | 4 | 364 | 1184 | 76% | 84 | 89 | 51% |
| 2002 | 6 | 263 | 868 | 77% | 69 | 71 | 51% |
| 2003 | 9 | 196 | 945 | 83% | 52 | 70 | 57% |
| 2004 | 8 | 158 | 792 | 83% | 42 | 57 | 57% |
| 2005 | 8 | 143 | 710 | 83% | 47 | 51 | 52% |
| 2006 | 9 | 166 | 997 | 86% | 57 | 67 | 54% |
| 2007 | 10 | 214 | 700 | 77% | 67 | 57 | 46% |
| 2008 | 10 | 169 | 902 | 84% | 61 | 69 | 53% |

**Table 4.3.** Dab. Average landings (L), discards (D) and percentage discards (%D) per hour and per period in numbers (left) and weight (right) for beam trawl vessels. Results over 1976-1983 and 1989-1990 from Van Beek (1998), 1999-2001 from Netherlands Institute for Fisheries Research unpublished data.

| Year/ | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|
| Period | N trips | L | D | %D | L | D | %D |
| 1976-1979 | 21 | 12 | 917 | 99% | 4 | 65 | 95% |
| 1980-1983 | 24 | 31 | 796 | 96% | 7 | 60 | 90% |
| 1989-1990 | 6 | 15 | 2147 | 99% | 2 | 123 | 98% |
| 1999 | 3 | 112 | 1411 | 93% | 13 | 106 | 89% |
| 2000 | 12 | 28 | 951 | 97% | 6 | 49 | 89% |
| 2001 | 4 | 125 | 2268 | 95% | 12 | 97 | 89% |
| 2002 | 6 | 92 | 934 | 91% | 11 | 57 | 84% |
| 2003 | 9 | 60 | 1166 | 95% | 8 | 64 | 89% |
| 2004 | 8 | 54 | 1037 | 95% | 7 | 51 | 87% |
| 2005 | 8 | 25 | 492 | 95% | 6 | 52 | 90% |
| 2006 | 9 | 46 | 2335 | 98% | 9 | 79 | 90% |
| 2007 | 10 | 81 | 1196 | 94% | 12 | 62 | 83% |
| 2008 | 10 | 51 | 905 | 95% | 8 | 49 | 87% |

**Table 4.4.** Whiting. Average landings (L), discards (D) and percentage discards (%D) per hour and per period in numbers (left) and weight (right) for beam trawl vessels. Results over 1976-1983 and 1989-1990 from Van Beek (1998), 1999-2001 from Netherlands Institute for Fisheries Research unpublished data. *nm*=not measured.

| Year/ | | Numbers | | | Weight | | |
|---|---|---|---|---|---|---|---|
| Period | N trips | L | D | %D | L | D | %D |
| 1976-1979 | 21 | 10 | 34 | 78% | 3 | 5 | 62% |
| 1980-1983 | 24 | 21 | 89 | 81% | 5 | 11 | 69% |
| 1989-1990 | 6 | 5 | 122 | 96% | 1 | 17 | 95% |
| 1999 | 3 | *nm* | 77 | | <1 | 10 | 93% |
| 2000 | 12 | *nm* | 117 | | 2 | 9 | 85% |
| 2001 | 4 | *nm* | 69 | | 1 | 9 | 86% |
| 2002 | 6 | 14 | 104 | 88% | 1 | 7 | 85% |
| 2003 | 9 | 2 | 40 | 96% | <1 | 3 | 86% |
| 2004 | 8 | 0 | 46 | 100% | <1 | 2 | 92% |
| 2005 | 8 | 3 | 18 | 85% | <1 | 2 | 85% |
| 2006 | 9 | *nm* | 36 | | <1 | 3 | 74% |
| 2007 | 10 | 0 | 10 | 100% | <1 | 3 | 87% |
| 2008 | 10 | 0 | 15 | 100% | <1 | 3 | 93% |

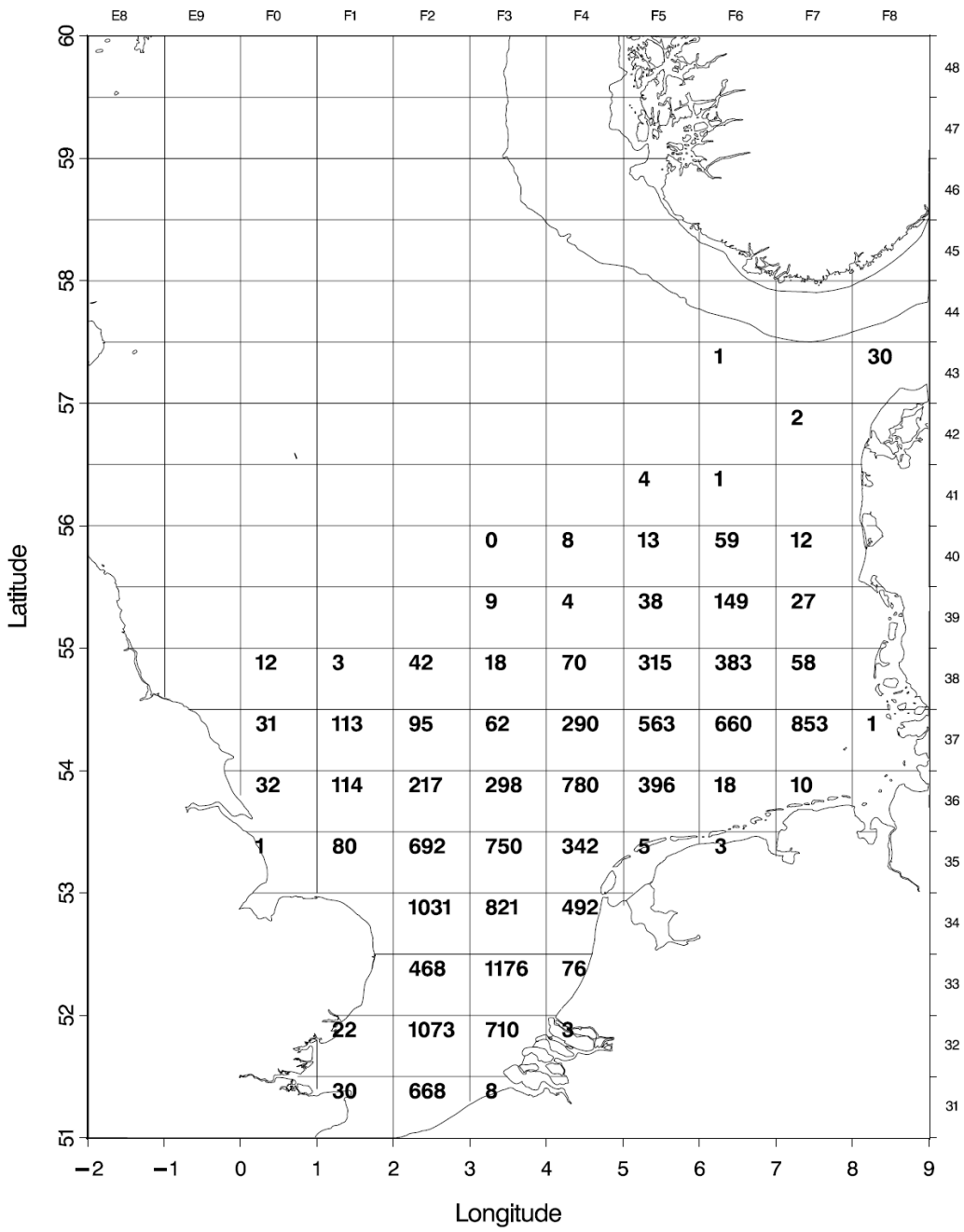


**Figure 3.1.1a.** Distribution of effort in days at sea by the Dutch beam trawl fleet in 2008, for vessels larger than 300 HP using 80 mm cod-end mesh size. Data from VIRIS database.

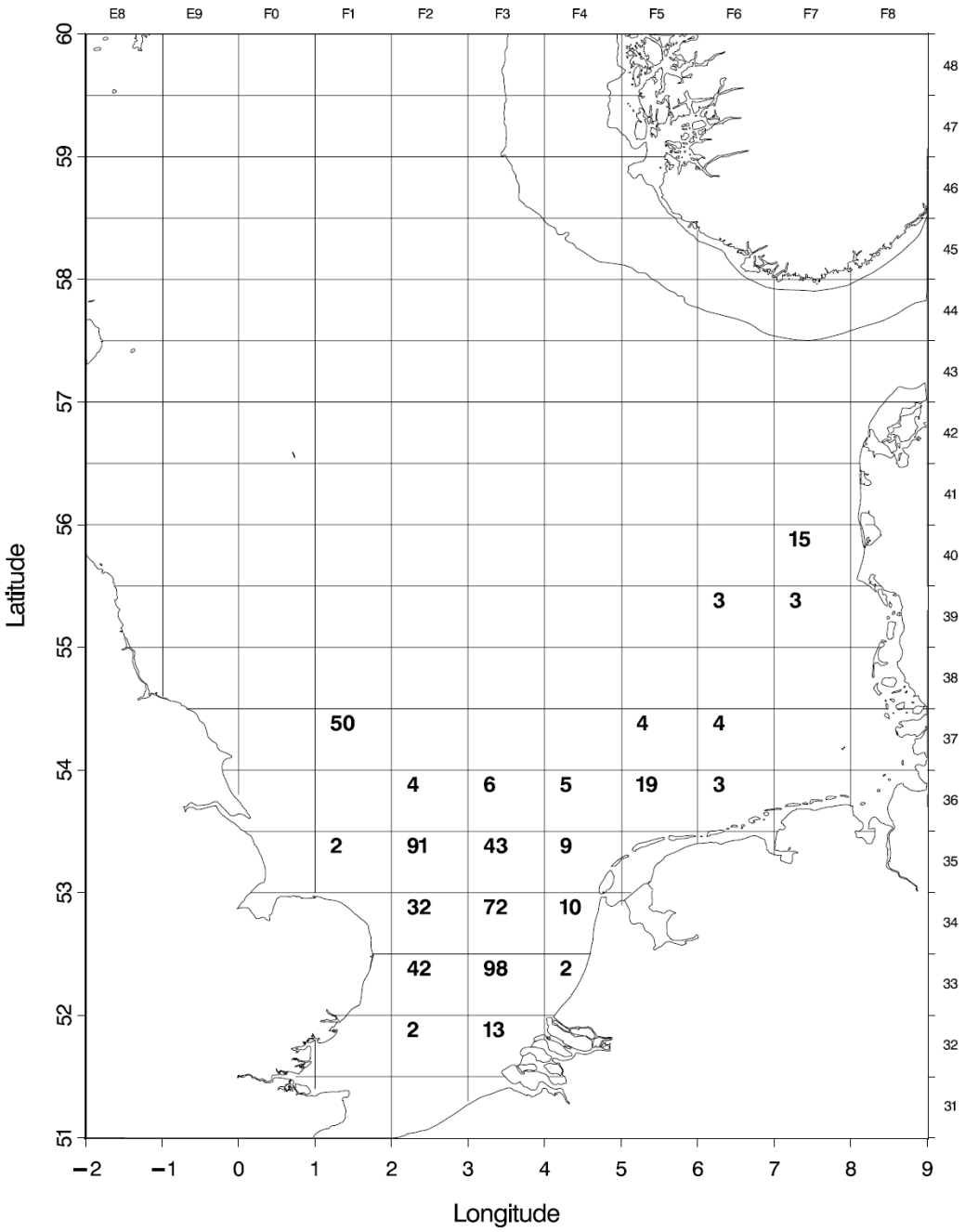


**Figure 3.1.1b.** Distribution of hours sampled for the sampled Dutch beam trawl fleet in 2008 for vessels larger than 300 HP fishing using 80 mm cod-end mesh size.

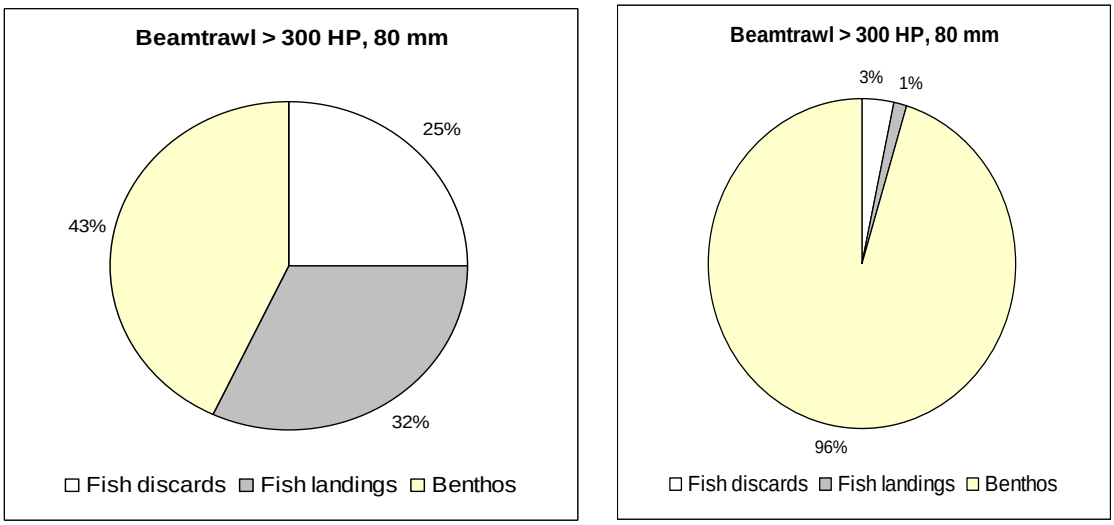


**Figure 3.2a.** Composition of the catch in weight **(left panel)** and numbers **(right panel)** for beam trawl vessels larger than 300 HP using 80 mm cod-end mesh size.

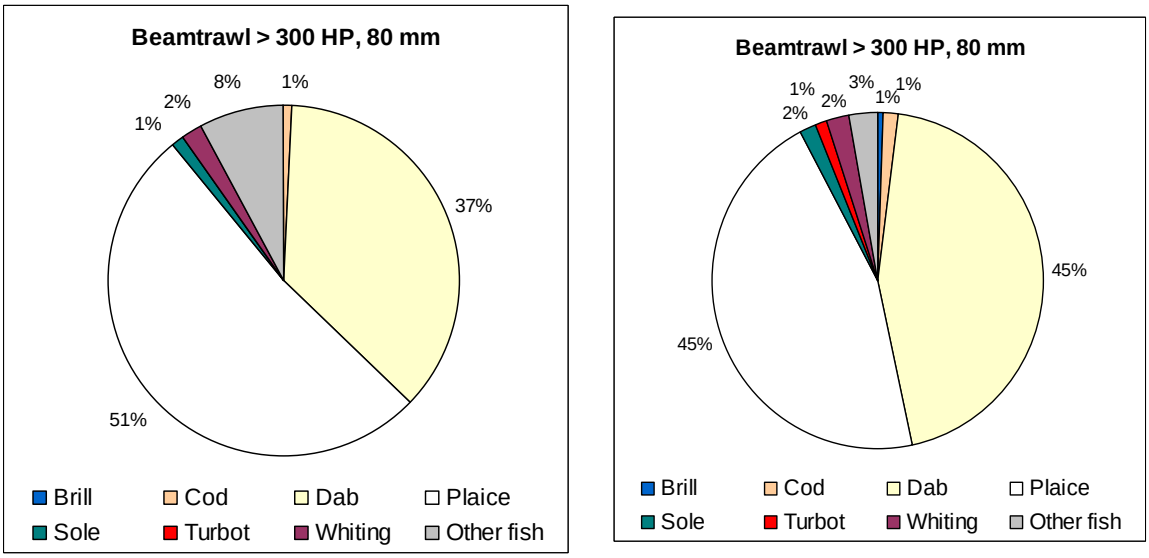


**Figure 3.2b.** Composition of fish discards in weight **(left panel)** and numbers **(right panel)** for beam trawl vessels larger than 300 HP using 80 mm cod-end mesh size.

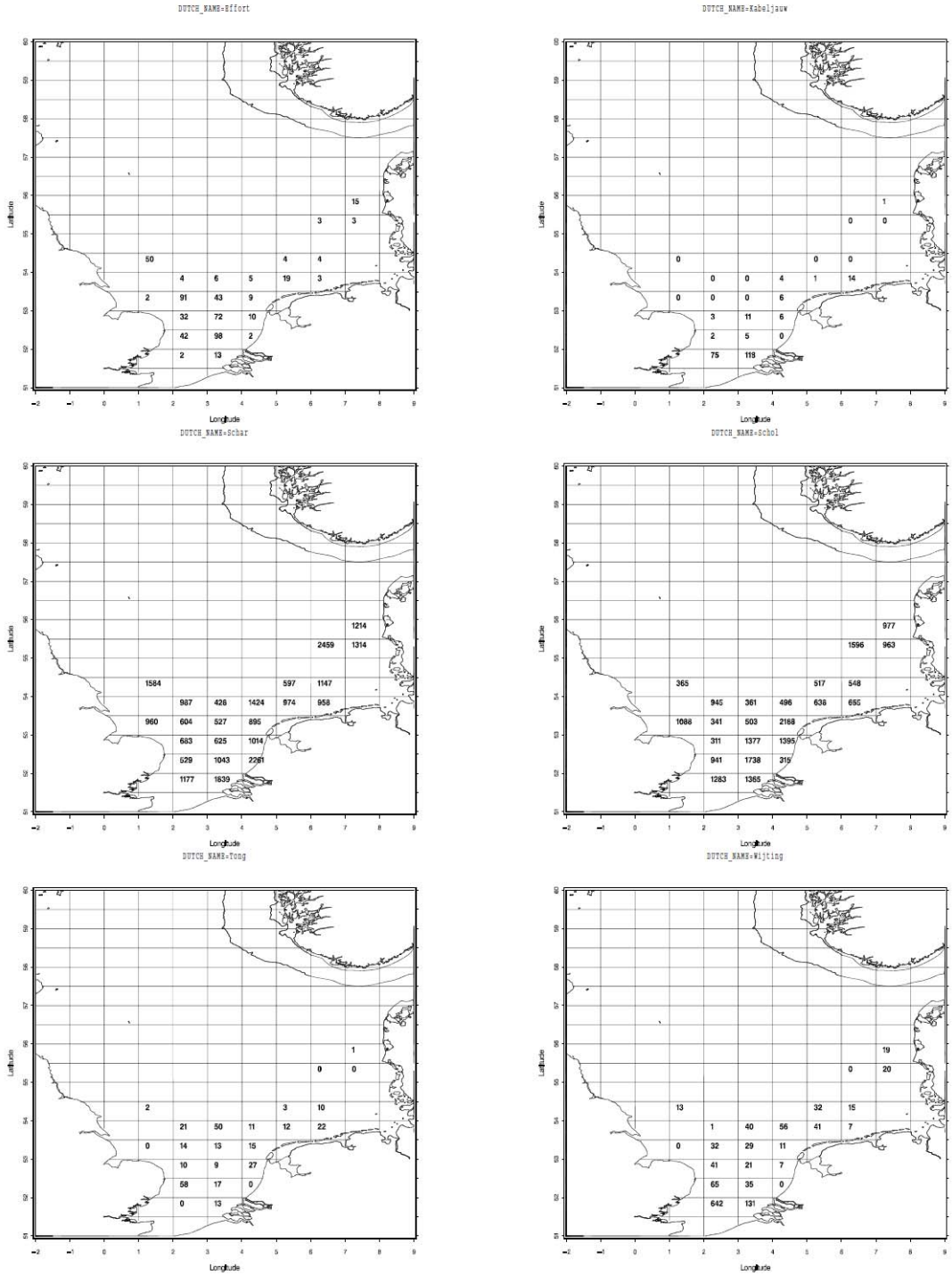


**Figure 3.3.1**. Effort as sampled hours for discards (upper left) and number of discards per hour per ICES area in 2008 for cod (upper right), dab (middle left), plaice (middle right), sole (lower left) and whiting (lower right) for beam trawl vessels larger than 300 HP using 80 mm cod-end mesh size.

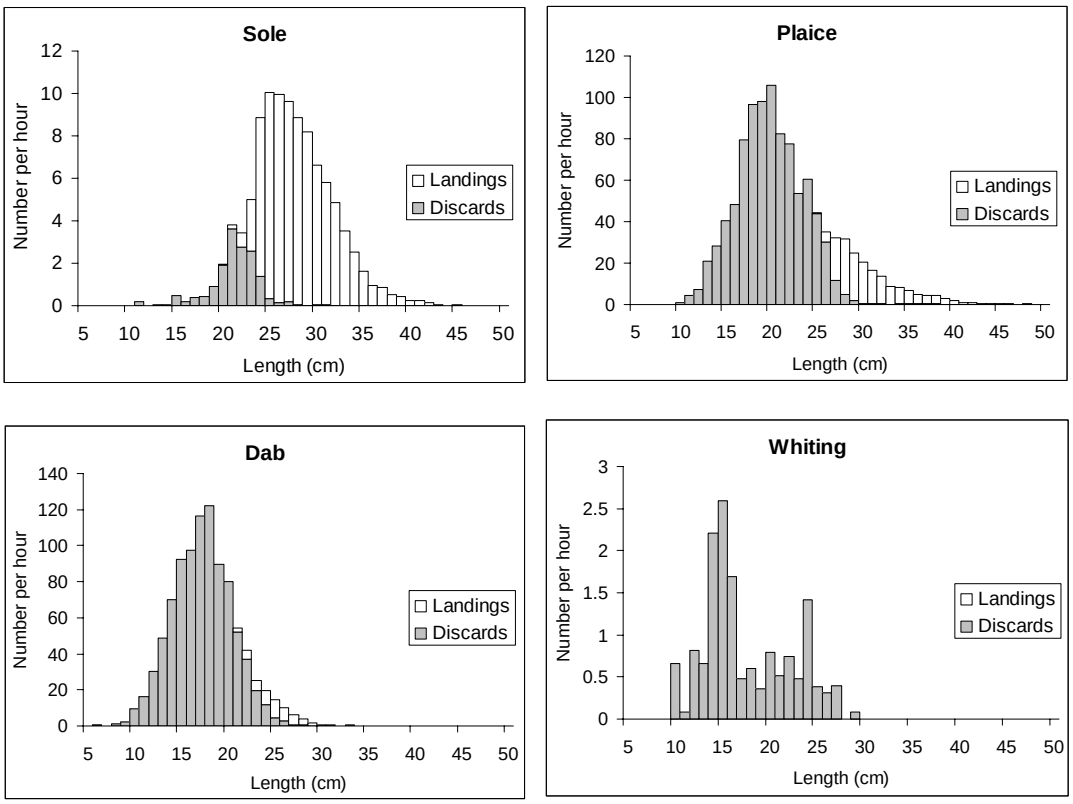


**Figure 3.4.1.** Length frequency distribution of plaice, sole, dab, whiting and cod in 2008, caught with beam trawl vessels larger than 300 HP fishing with 80 mm cod-end mesh size. Black bars show discards, white bars show landings.